DEVELOPING A MANUAL FOR THE IDENTIFICATION OF STRUCTURAL PATHOLOGIES FOR THE REPAIR OF MASONRY SOCIAL HOUSING IN METROPOLITAN LIMA DIGITE EL NOMBRE EXACTO DEL TÍTULO PROFESIONAL.

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ABSTRACT

The objective of the research is to present the development of a manual for the Identification of structural pathologies for the repair of masonry social housing in Metropolitan Lima. The research was of the applied type with a non-experimental cross-sectional quantitative approach. The sample was six masonry houses located in the district of Ate Vitarte; the main results: With the guide of visual inspection of concrete in housing - ACI 201.1R-08; describes the structure and materials used being confined masonry housing, the nature of the environmental conditions shows the type of exposures by environmental conditions, with the danger indicators, locate the risks for a prompt repair, the current state of the structure finds the degree of deficiency in its structural elements and with the diamond tests on beams and columns shows that 100% of the houses have a deficiency in concrete strength and finally concludes the development of a manual will allow the effective repair of structural elements in social housing of masonry.

Keywords: Identification Manual, structural pathology, masonry, masonry

RESUMEN

La investigación tuvo como objetivo presentar el desarrollo de un manual de identificación de patologías estructurales para la reparación de viviendas sociales de albañilería en Lima Metropolitana. La investigación fue del tipo aplicada con un enfoque cuantitativo no experimental transversal. La muestra fue 6 viviendas de albañilería, ubicada en el distrito de Ate Vitarte, los principales resultados: Con la guía de inspección visual del concreto en la vivienda - ACI 201.1R-08; describe la estructura y materiales usados siendo viviendas de albañilería confinada, la naturaleza de las condiciones ambientales muestra el tipo exposiciones por las condiciones ambientales, con los indicadores de peligro ubican los riegos para una reparación pronta, el estado actual de la estructura encuentra el grado de deficiencia en sus elementos estructurales y con los ensayos de diamantina en vigas y en columnas muestra que el 100% de las viviendas presenta deficiencia en resistencia del concreto y finalmente se concluye el desarrollo de un manual permitirá la reparación eficaz de elementos estructurales en viviendas sociales de albañilería.

Palabras Clave: Manual de Identificación, patología estructural, albañilería

CHAPTER I. INTRODUCTION

1.1. Problematic reality

The earthquakes and catastrophic events experienced in Peru led to providing and applying a correct design for housing correction, focusing on housing with deficiency and technical assistance in its conception.

Since the 20th century, concrete has become the most widely used construction material worldwide due to its versatility, and its development has been linked to

reinforced concrete and, with it, the development of technologies since its industrialization to meet the needs of humanity (Sanchez, 2001, p. 21).

In Peru, confined masonry was introduced after the 1940 earthquake, while reinforced masonry was introduced in the 1960s, although it had been created earlier.

According to history, the rational study of masonry began only after the tests were carried out in the United States (1913) and India (1920). In Peru, the first tests on masonry elements were carried out in the ’70s and the scarce results achieved until 1982 were used to elaborate our first regulation specifically related to masonry (Norm E-070, ININVI-82); to date, research continues.

It should be noted that unlike other materials (such as steel and reinforced concrete), the adaptations of foreign design standards are inapplicable to Peruvian masonry; this is due to the enormous difference in construction materials, labor and construction techniques used in other countries **(San Bartolome, 1994, p.16)**. **(San Bartolome, 1994, p.16),** concluding that the pathologies found in Social Masonry are based on research and results according to national problems.

According to the scientific article: “Pathologies, causes and solutions of architectural concrete in Medellín” (Figueroa et al., 2008), concluded as follows:

The construction of concrete architectural elements with the required aesthetic specifications is possible if a planned and standardized process is followed, with quality materials and equipment, skilled labor and efficient supervision.

The present research defines, according to Rivva (2006), concrete pathology as the systematic study of the processes and characteristics of the “diseases” or defects and damages that concrete can suffer, their causes, consequences and remedies Pathology

is that part of durability that refers to these signs, possible causes and diagnosis of the territory that concrete experiences (p.45). Therefore, the present research concludes by Performing a Visual Inspection to appreciate the real conditions of each element or Dwelling.

For Rivva (2006, p. 5), the durability of a concrete structure is defined by Committee 201 of the American Concrete Institute (ACI) as "the ability of the concrete to resist the action of interpermeability, chemical attacks, abrasion, or any other type of deterioration. Other researchers are inclined to define the durability of a structure as "the capacity of concrete to withstand, during its useful life and conclude that it is an essential aspect of the quality of the structure being as important as resistance. For Rivva (2006, p.48), concrete sampling checks whether the concrete's quality corresponds to the Dwelling's strength requirements.

Bedoya (2010), in the thesis entitled "Pathological evaluation of the National Police building located on Jorge Drom and Unión Nacional de Periodistas streets, in the city of Quito," field and laboratory tests were carried out, such as concrete compressive strength of the extracted cores for quality control during the construction process (p.2). Furthermore, as described above, the work also consisted of performing resistance tests according to ASTM C42 M and for the correct durability.

Description of the structure

Cortes & Perilla (2017), in thesis entitled "Identification of structural pathologies in indispensable buildings in the municipality of Santa Rosa de Cabal (educational sector)," aimed to evaluate the most recurrent structural pathologies in the educational infrastructure of the municipality of Santa Rosa de Cabal, whose

population is a municipality of Santa Rosa de Cabal located in the Colombian Andean area, its sample is the educational institutions evaluated and is qualitative as descriptive.

The work consisted of a visit to each educational institution using the technical data sheet prepared, after which a comparative table was prepared to recognize the most recurrent pathologies. The following results were obtained for the description of the structure and materials used; the five educational entities of confined masonry were found for the nature of the environmental conditions if it presents aggressive exposures such as humidity in the structure, corrosion and stains. These educational entities are 90% affected by environmental conditions, for the hazard indicators: most (60%-80%) present settlements and damages in their structures.

For the current state of the structure, they present corrosion, cracks, decarburization, cavities, detachment or loss of material: in addition, the analysis showed that 100 % of the analyzed educational entities present at least one problem in their analyzed structures.

1.2. Problem formulation

1.2.1. General:

How can developing a manual for identifying structural pathologies reduce failures in masonry social housing in Metropolitan Lima?

1.2.2. Specific:

- How does the Manual of Identification of structural pathologies reduce failures in masonry social housing about the visual inspection of concrete in housing - ACI 201?1R-08 in Metropolitan Lima?
- How does the Manual for identifying structural pathologies reduce failures in masonry social housing about diamond testing in Metropolitan Lima?

1.2.3. Overall objective

- To present the development of a manual for the Identification of structural pathologies to reduce failures in masonry social housing in Metropolitan Lima.

1.2.4. Specific objectives

Establish a manual for identifying structural pathologies to reduce failures in masonry social housing about the visual inspection of concrete in housing - ACI 201.1R-08 in Metropolitan Lima.

- Establish a manual for identifying structural pathologies to reduce failures in masonry social housing about Diamantina tests in Metropolitan Lima.

1.2.5. Hypothesis

1.2.6. General hypothesis

- The development of a manual for the Identification of structural pathologies helps to reduce failures in masonry social housing in Metropolitan Lima.

1.2.7. Specific hypotheses

- The development of a manual for identifying structural pathologies allows the reduction of failures in masonry social housing concerning the visual inspection of the concrete in the house - ACI 201.1R-08 in Metropolitan Lima.
- The development of a manual for identifying structural pathologies allows the reduction of failures in masonry social housing concerning diamond tests in Metropolitan Lima.

CHAPTER II. METHODOLOGY

2.1. Type of Research

In Vargas et al. (2009), some authors mention two trends for research. The first is basic research, also known as fundamental, exact or pure research, which deals with the object of study without considering an immediate application, but taking into account that, from its

results and discoveries, new products and scientific advances may arise (Cívicos and Hernández, 2007; Padrón, 2006). The second is applied research, understood as the use of knowledge in practice to apply it for the benefit of the groups involved in these processes and society in general, in addition to the wealth of new knowledge that enriches the discipline. In this regard, in the pure sciences and basic research, the aim is to find out how things work for later use, while in the practical sciences, the purpose of applied research is to make immediate use of existing knowledge.

According to Sampieri (2014), quantitative, qualitative and mixed approaches are possible choices to address research problems and are equally valuable. This is because they are, so far, the best ways designed by humanity to investigate and generate knowledge; the quantitative approach uses data collection to test hypotheses based on numerical measurement and statistical analysis in order to establish patterns of behavior and test theories, the qualitative use data collection and analysis to refine research questions or reveal new questions in the process of interpretation.

In this case, it uses the applied type of research with a quantitative approach.

In the literature on quantitative research, it is possible to find different classifications of designs. This work adopts the following classification:1 experimental and non-experimental (p.129).

Sampieri, RH (2014, p.126) Chapter 7; Conception or choice of research design is divided into two types Experimental and Non-Experimental.

In an experimental study, the context is constructed, the independent variable is intentionally manipulated, and the effect of this manipulation is observed on the dependent variable (p. 153).

Experimental research is classified by its temporal dimension or the number of moments or points at which data are collected. The term experiment has at least two meanings, one general and one particular. The general one refers to "choosing or performing an action" and observing the consequences (Babbie, 2014). The essence of this conception of the experiment is that it requires the intentional manipulation of action in order to analyze its possible outcomes (p.129).

Non-experimental research could be defined as research that is carried out without deliberately manipulating variables. These are studies in which it does not intentionally vary the independent variables to see their effect on other variables. It is done in non-experimental research to observe phenomena as they occur in their natural context to analyze them (Sampieri, 2014, p.152A).

Non-experimental research is subdivided into cross-sectional and longitudinal designs. Transactional or cross-sectional research designs collect data simultaneously (Liu, 2008 and Tucker, 2004). They aim to describe variables and analyze their incidence and interrelationship at a given time. Then longitudinal designs collect data at different times or periods to make inferences about change, its determinants and consequences (p.159).

In this case, it will use the non-experimental cross-sectional type of research.

2.2. Population and sample (Materials, instruments and methods)

2.2.1. Population

According to Bernal (2010), the population, according to France (1988), is "the set of all the elements to which the research refers. It can also be defined as the set of all sampling units.

The National Institute of Statistics and Informatics (2018) indicates that, of the entire population of Lima, according to the INEI (National Institute of Statistics and Informatics) it stands out for having the highest percentage (85.6%) of dwellings with exterior walls of brick or cement blocks

According to Fondo Mivivienda (2018), in the Housing Demand Study at the level of the main cities, almost all the heads of households (99.4%) have an independent house. With an average of 110.0 m2 and an average number of floors up to two in socioeconomic Levels C AND D, the two main reasons for dissatisfaction with housing are the lack of completion/improvements such as greater security.

According to INEI, Lima Metropolitana is the reference in Peru; it represents the country's highest concentration, and the most populated districts are San Juan de Lurigancho, San Martin de Porres and Ate for 2015.

2.2.2. Sample

According to Bernal (2010), the sample is the part of the selected population from which the information for the study development is obtained, and the measurement and observation of the variables under study will be carried out.

According to Sampieri (2014), in quantitative research, a sample selection method is chosen; probabilistic or non-probabilistic. For the probability sample, it is required to specify the sample size through a list and procedures. On the other hand, the non-probabilistic sample selects cases or units for one or several purposes and does not pretend that the cases are statistically representative. Thus, it is developed with a careful and controlled choice of cases and the correct delimitation; finally, it is valid through expert judgment.

For the above reasons, the analysis of 6 confined masonry houses in the District of Ate Vitarte - Lima - Lima, Peru, is considered for the entire population.

2.3. Techniques and instruments for data collection and analysis

2.3.1. Technique

According to Bernal (2010), there is a wide variety of techniques or instruments for collecting information in the fieldwork of a given investigation. According to the method and type of research to be conducted, one or another technique is used. The author makes a general presentation of the main techniques or instruments for collecting information in a research process. These techniques have application in any qualitative and quantitative research approaches, surveys, interviews, direct observation, data analysis and the internet. The interview is applied because our technique is based on obtaining direct and reliable information as long as it is done through a systematized and controlled process.

2.3.2. Collection instruments

Sampieri (2014) defines measurement as the process of linking abstract concepts with empirical indicators", which is carried out through a detailed and organized plan to classify (and often quantify) the available data (the indicators) in terms of the concept that the researcher has in mind (Carmines and Zeller, 1991). The measurement or data collection instrument plays a central role in this process. Without it, there are no classified observations. This is divided into three data collection instruments which are the questionnaire, interview and observation, for this study, observation is a type of technique and collection instrument; likewise, Bernal (2016) indicates that for the observation technique, there is no single model or

guide to collect scientific information, but in general, it must comply with the collection phases which are information, observation and completion; then for the thesis, it chooses the survey to comply with the indicated phases and respond to the study objectives.

The following is the survey to be used:

- Survey for validation of the Manual for Identification of structural pathologies for the repair of masonry social housing.

According to Bernal (2010), the elaboration of the survey indicates fifteen questions to verify validity and reliability through expert judgment.

- ✓ Expert 1: Eng. Luis Flores Tantaleán: CIP N° 43301 (Annex N°4)
- ✓ Expert 2: Eng. William Baca Escobar: CIP N° 41804 (Annex N°4)
- ✓ Expert 3: Eng. Milan Pejnovic: (Attachment N°4)

2.3.3. Data analysis

- According to Sampieri (2014), it is divided into inferential and descriptive statistics. Inferential statistics aims to test hypotheses and generalize the results obtained in the sample to the population or universe. Descriptive statistics is the part of statistics that summarizes the information from the sample. It will choose inferential statistics; the population is social housing in the District of Ate Vitarte, and the sample is six confined masonry houses. The present investigation, being non-probabilistic, will be validated by expert judgment; through a survey for the reliability of the instruments used and delivered in the Manual; Likert scale.

2.4. Procedure

2.4.1. Delimitation of the project

To arrive at the evaluation of housing as per the Manual, this has been through the collection of statistical data to delimit the evaluation of housing in Metropolitan Lima.

- Statistical data collection

PERÚ: CIUDADES CON MAYOR POBLACIÓN, 2015

Puesto	Ciudad	Población
1	Lima Metropolitana	9 886 647
2	Arequipa	869 351
3	Trujillo	799 550
4	Chiclayo	600 440
5	Iquitos	437 376

Fuente: Instituto Nacional de Estadística e Informática. Perú: Estimaciones y Proyecciones de Población Total y por Sexo de las Ciudades Principales, 2000-2015. Boletín Especial N° 21.

Figure 1. Cities with the highest population density in Peru- INEI 2015.

Figure 2. Districts with the largest population, 2015.

MATERIALES PREDOMINANTES EN PARED, PISO Y TECHO DE LAS VIVIENDAS

	Total	NSE B	NSE C	NSE D
Total	**416,630**	**67,342**	**212,151**	**137,137**
Paredes (%)				
Ladrillo o bloque de cemento	96.5	100.0	95.3	96.7
Madera	2.1	--	3.3	1.3
Piedra o sillar con cal o cemento	0.9	--	1.3	0.7
Adobe	0.2	--	--	0.7
Quincha (caña con barro)	0.2	--	--	0.7
Pisos (%)				
Cemento	71.6	61.0	76.0	70.0
Losetas, terrazos o similares	23.1	36.0	20.7	20.7
Parquet o madera pulida	1.7	1.0	2.7	0.7
Tierra	1.5	2.0	0.7	2.7
Madera (entablados)	1.5	--	--	4.7
Láminas asfálticas, vinílicos o similares	0.4	--	--	1.3
Techos (%)				
Concreto armado (loza aligerada o maciza)	85.4	89.0	87.3	80.7
Planchas de calamina, fibra de cemento o similares	11.6	11.0	9.3	15.3
Madera	2.3	--	2.0	4.0
Tejas	0.3	--	0.7	--
Caña o estera con torta de barro	0.3	--	0.7	--

Figure 3. Fondo Mi Vivienda materials predominant in the Lima area.

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Similarly, in the statistical data, the main reasons for dissatisfaction with housing for the homeowner population are the lack of improvements or the need for greater security.

PRINCIPALES RAZONES DE INSATISFACCIÓN CON LA VIVIENDA (%)

	Total	NSE B	NSE C	NSE D
Total	**25,171**	**4,714**	**11,315**	**9,142**
Falta terminar la vivienda/falta hacer mejoras	60.6	57.1	62.5	60.0
Requiere mayor seguridad	13.6	14.3	--	30.0
Falta espacio	8.3	14.3	12.5	--
Mala ubicación	6.3	14.3	--	10.0
Falta mantenimiento	5.6	--	12.5	--
Porque le faltan los acabados	5.6	--	12.5	--

Figure 4. Fondo Mi Vivienda materials predominant in the Lima area.

These data provide us with population support for the need to have decent and safe housing.

- Advice from specialized engineers;

  With the support of sponsoring partners of the National Chapter of the American Concrete Institute (ACI PERU), this research was elaborated using standardized elements and a characteristic order.

- Meeting with neighborhood leaders of the district of Ate Vitarte. A meeting was organized with the presidency of leaders so that they can provide us with housing and, together with them, security and provide fluidity in the extraction process of cylindrical cores.

2.4.2. Fieldwork, data collection

- Recruitment of skilled laborers for home repairs

  For this point, the sponsoring partners of ACI PERU provided the personnel to carry out the extraction of cores as the resins in the structural elements (ASTM C42), which under the standard corresponds to the extraction of cylindrical cores and after them the compression test.

  - Resources, materials and equipment

Figure 5. Image of the operating personnel specialized in cylindrical coring.

Figure 6. Picture of materials and equipment for cylindrical coring.

A visit was made to 6 confined masonry houses in different areas so that the MO and material deficiency factors would not coincide with the construction of each house.

- Cylindrical coring with a diamond core drilling rig.

Figure 7. Core extraction process.

Figure 8. Identification process of the extracted cylindrical core.

- Repair or resurfacing of cored areas.

The materials used were cementitious mortar of high strength or greater than the design of the house, together with a primer for proper adhesion.

Figure 9. Repair process of the extracted cylindrical core.

- Three core extractions per Dwelling (columns and beam)

The extraction of 3 cores per house was developed to verify the homogeneity of the results in the construction process.

- Collection of visual data (photographs and sketches of the house).

In this phase, a sketch was made to structurally survey by means of a plan view, identifying the structural elements and pointing out the tested ones.

Figure 10. Cylindrical coring process.

Figure 11. Façade view. Quispe Blaz family.

With the sketch of each house, a structural and wall plan was developed. This allows identifying the elements tested, the distribution of the house, m^2 and the calculation of wall density.

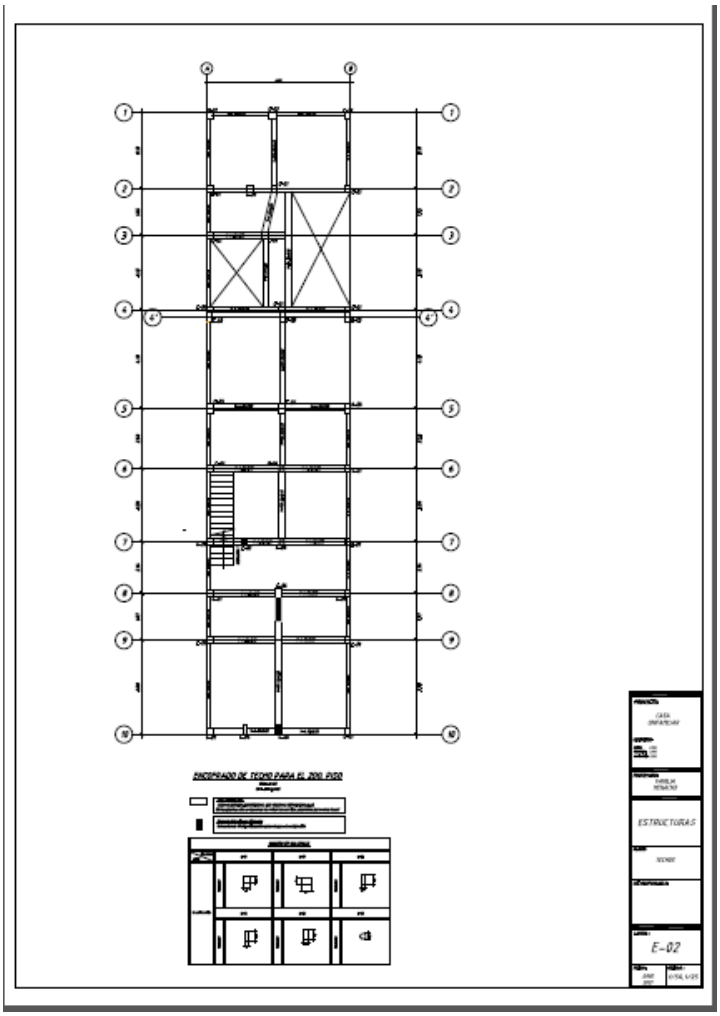


Figure 12. Plan view - Menacho Family Structures.

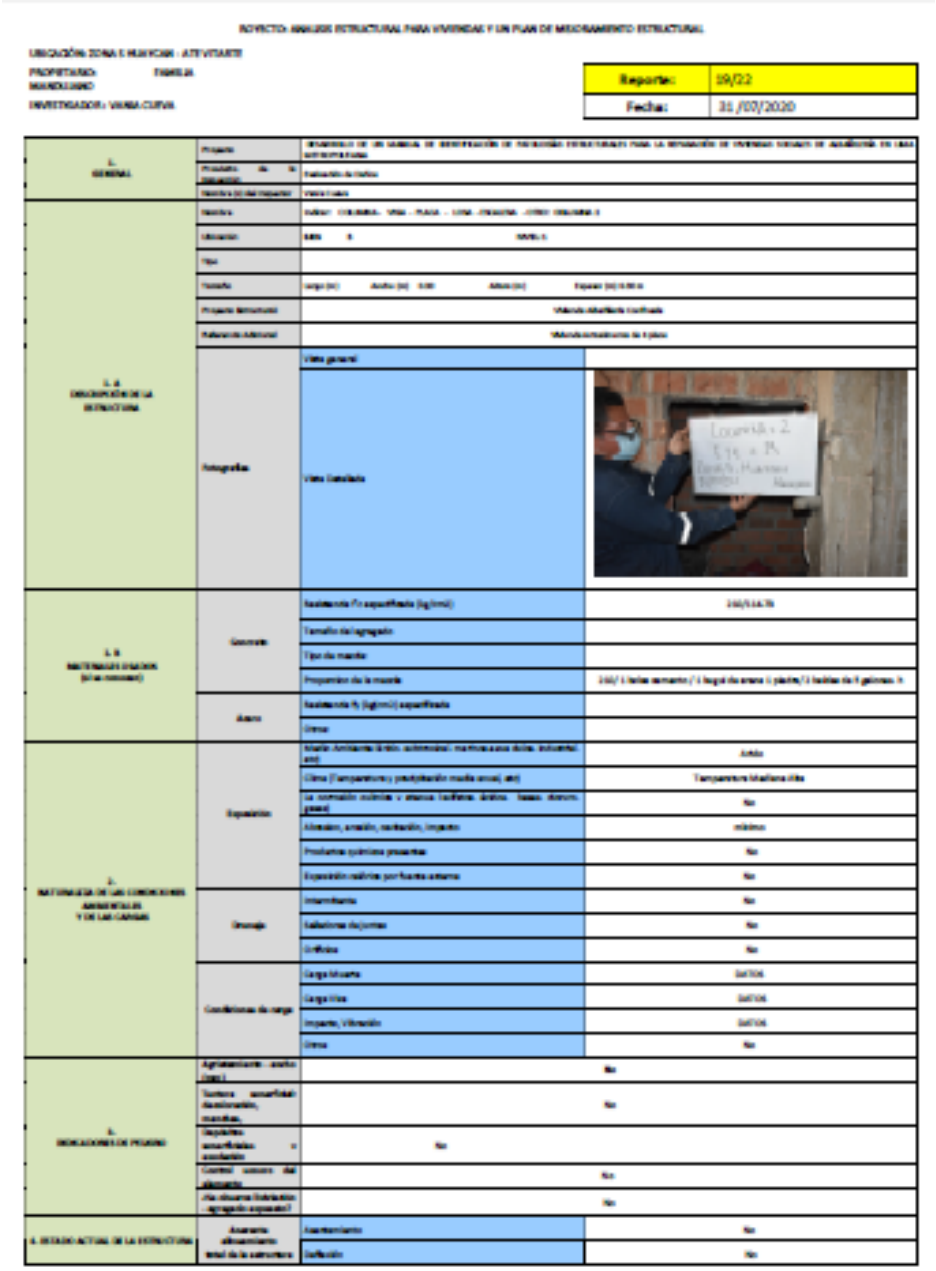
2.4.3. Manual

- Use of ACI 201.1R-08 standardized inspection models

  This visual inspection model of the concrete was developed throughout the six dwellings and this table shows the following details

  - General data and description of the structure.
  - Materials used.
  - Nature of environmental conditions and loads.
  - Hazard indicators

- Current status of the structure

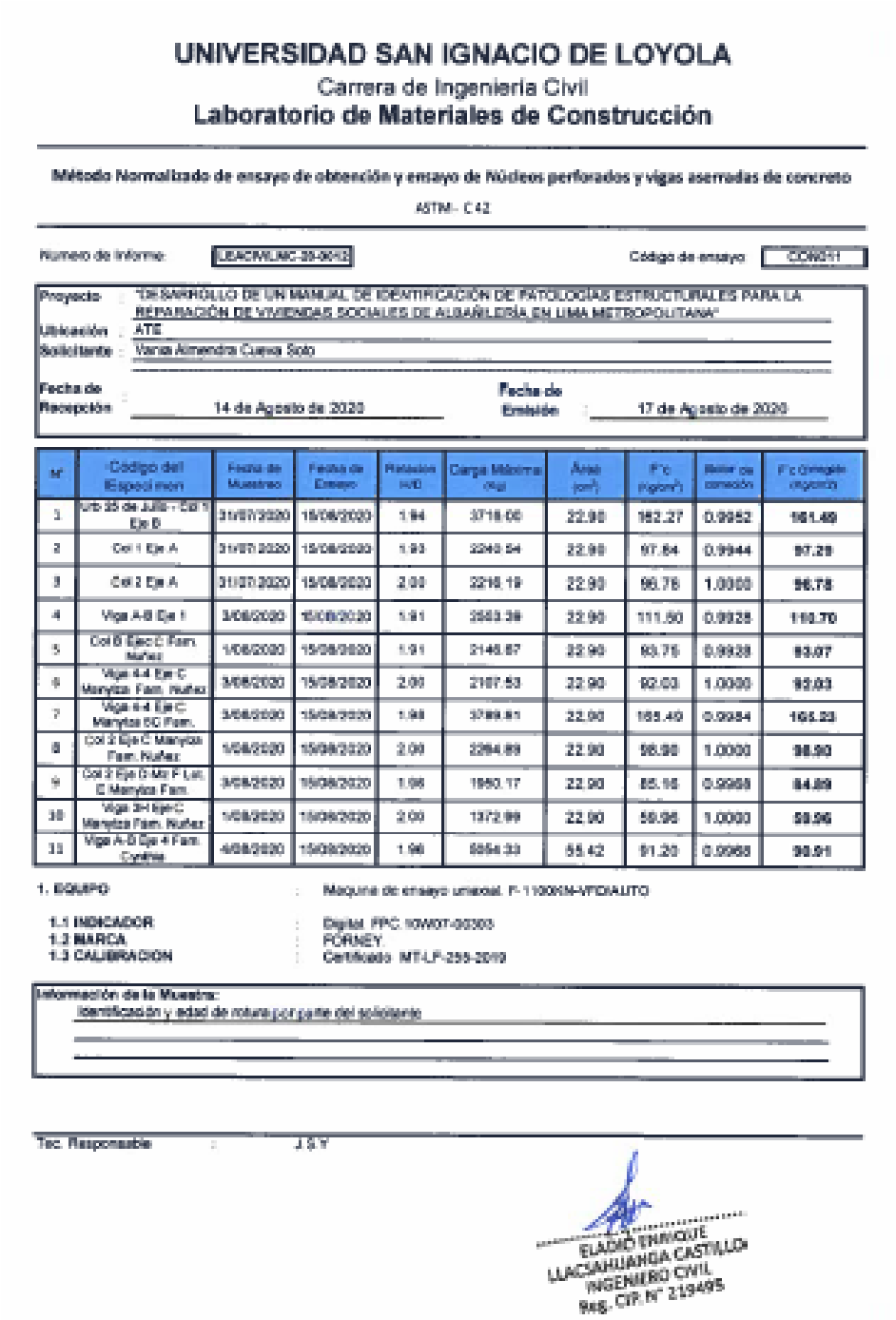


Reporte:	19/22
Fecha:	31 /07/2020

Figure 13. Diamond core extraction process.

- Laboratory extracted cylindrical core testing and validation (ASTM C42/C42M- 20).

The cores were taken to an entity to be tested, and the resistance results were obtained for each house.



UNIVERSIDAD SAN IGNACIO DE LOYOLA
Carrera de Ingeniería Civil
Laboratorio de Materiales de Construcción

Método Normalizado de ensayo de obtención y ensayo de Núcleos perforados y vigas aserradas de concreto
ASTM- C 42

Numero de Informe: LEAC/MLMC-39-0013 Código de ensayo: CO0071

Proyecto : "DESARROLLO DE UN MANUAL DE IDENTIFICACIÓN DE PATOLOGÍAS ESTRUCTURALES PARA LA REPARACIÓN DE VIVIENDAS SOCIALES DE ALBAÑILERÍA EN LIMA METROPOLITANA"
Ubicación : ATE
Solicitante : Vania Almendra Cueva Soto
Fecha de Recepción : 14 de Agosto de 2020 Fecha de Emisión : 17 de Agosto de 2020

N°	Codigo del Especimen	Fecha de Muestreo	Fecha de Ensayo	Relacion H/D	Carga Máxima (kg)	Área (cm²)	F'c (kg/cm²)	Factor de corrección	F'c Corregido (kg/cm2)
1	Urb 22 de Julio - Col 1 Eje B	31/07/2020	15/08/2020	1.94	3718.00	22.90	162.27	0.9952	161.49
2	Col 1 Eje A	31/07/2020	15/08/2020	1.93	2240.24	22.90	97.84	0.9944	97.29
3	Col 2 Eje A	31/07/2020	15/08/2020	2.00	2216.19	22.90	96.78	1.0000	96.78
4	Viga A-B Eje 1	3/08/2020	15/08/2020	1.91	2553.39	22.90	111.50	0.9928	110.70
5	Col B Eje C Fam. Nuñez	1/08/2020	15/08/2020	1.91	2146.87	22.90	93.75	0.9928	93.07
6	Viga 4-4 Eje C Manyloa Fam. Nuñez	3/08/2020	15/08/2020	2.00	2197.53	22.90	92.03	1.0000	92.03
7	Viga 4-4 Eje C Manyloa 02 Fam.	3/08/2020	15/08/2020	1.98	3789.81	22.90	165.40	0.9984	165.23
8	Col 2 Eje C Manyloa Fam. Nuñez	1/08/2020	15/08/2020	2.00	2264.89	22.90	98.90	1.0000	98.90
9	Col 2 Eje D Mz F Lot. C Manyloa Fam.	3/08/2020	15/08/2020	1.99	1950.17	22.90	85.16	0.9968	84.89
10	Viga 3-I Eje C Manyloa Fam. Nuñez	1/08/2020	15/08/2020	2.00	1372.99	22.90	59.96	1.0000	59.96
11	Viga A-B Eje 4 Fam. Cynthia	4/08/2020	15/08/2020	1.96	5054.33	55.42	91.20	0.9968	90.91

1. EQUIPO : Maquina de ensayo uniaxial. F-1100KM-VFDAUTO
1.1 INDICADOR : Digital FPC 10W07-00300
1.2 MARCA : FORNEY
1.3 CALIBRACION : Certificado MT-LF-255-2019

Información de la Muestra:
Identificación y edad de rotura por parte del solicitante

Tec. Responsable : J.S.Y

ELADIO ENRIQUE LLACSAHUANGA CASTILLO
INGENIERO CIVIL
Reg. CIP. N° 219495

*Figure **14*** Diamond core extraction process.

- Development of the Manual

The Manual was expressed in a table taken from Calavera (2005), which describes the possible causes of the findings and, in addition to the table, possible solutions were inserted.

A.6	Elementos porosos – concreto Pobre
	
1. CARACTERISTICAS: • El concreto sufre desprendimiento y no tiene consistencia, se presenta con mayor frecuencia en las losas.	
2. CAUSAS: • Mal diseño de concreto por la fabricación in situ en la Vivienda	
3. SOLUCIONES: •Limpiar la superficie y colocar un motero cementicio modificado de alta resistencia o mayor a la proyectada junto con un acrílico para mejor adherencia y mediante un solaqueo cubrir y así reforzar superficialmente el elemento. •Debemos tener consideración de prevención es la mejor opción para este tipo de fallas.	

Figure 15 View, model of the table used in this project.

2.4.4. Survey

For the evaluation of the Manual, a survey was sent to 3 expert engineers. This survey is based on a Likert scale format.

This is then translated into a scorecard to measure the degree of validity and reliability of the manual and whether it is suitable for use.

		Muy en desacuerdo	En desacuerdo	Indeciso	De acuerdo	Muy de acuerdo
1	¿Considera Ud. que el formato presentado para el desarrollo de las tablas del manual es el adecuado?					
2	¿De acuerdo a su inspección; la visualización de las patologías mediante dibujos didácticos mostrados en el manual; es comprensible?					
3	¿Cree Ud. Que las características patológicas (Item 1.) ubicadas en el manual, se detallan correctamente?					
4	¿Bajo su inspección ; podría con facilidad identificar en la realidad; las patologías mostradas en el manual?					
5	¿Cree Ud. que la explicación de las causas patológicas (Item2.) ubicadas en el manual; son las adecuadas?					
6	¿De acuerdo a la inspección del manual, considera Ud. que los materiales descritos para la reparación en el Item 3 (soluciones); cumplen con el objetivo de corregir el elemento estructural?					
7	¿ Cree Ud., según lo indicado en el Manual; el usuario podrá reparar sus elementos estructurales con facilidad y viabilidad económica?					
8	¿ Según su criterio; el manual de patología es el adecuado para identificar fallas estructurales en las viviendas sociales ubicadas Lima Metropolitana?					
9	¿De acuerdo a lo descrito en la tabla A.6 del Manual, cree Ud. que promover la oferta de concreto premezclado "social"; brindaría un mejor desempeño en la calidad y durabilidad de los elementos estructurales en una vivienda social?					
10	¿Cree Ud. que la aplicación del Manual previene desastres y brinda un mejor desempeño estructural en las viviendas sociales de Lima Metropolitana?					
11	¿Cree Ud. que en el futuro el uso del manual promoverá comitivas inter barrio para la reparación de los elementos estructurales en dichas viviendas?					
12	¿Cree Ud. que el manual es de fácil comprensión para un usuario inexperto?					
13	¿Cree Ud que al haber incluido en el manual; los ensayos diamantinos en los elementos estructurales mejorará la detección temprana de patologías?					
14	¿ Cree Ud. que la distribución y enseñanza del manual ayudará a disminuir el riesgo actual de las viviendas sociales en Lima Metropolitana?					
15	¿Considera Ud. que haber incluido el uso de la Guía de Inspección Visual ACI 201. 1R-08, ensayos de diamante como el levantamiento estructural respalda al Manual en estudio?					

Figure 16 View, model of the table used in this project.

Evaluation

		Muy en desacuerdo	En desacuerdo	Indeciso	De acuerdo	Muy de acuerdo
1	¿Considera Ud. que el formato presentado para el desarrollo de las tablas del manual es el adecuado?					5
2	¿De acuerdo a su inspección; la visualización de las patologías mediante dibujos didácticos mostrados en el manual; es comprensible?					5
3	¿Cree Ud. Que las características patológicas (Item 1.) ubicadas en el manual, se detallan correctamente?					5
4	¿Bajo su inspección ; podría con facilidad identificar en la realidad; las patologías mostradas en el manual?					5
5	¿Cree Ud. que la explicación de las causas patológicas (Item2.) ubicadas en el manual; son las adecuadas?					5
6	¿De acuerdo a la inspección del manual, considera Ud. que los materiales descritos para la reparación en el Item 3 (soluciones); cumplen con el objetivo de corregir el elemento estructural?					5
7	¿ Cree Ud., según lo indicado en el Manual; el usuario podrá reparar sus elementos estructurales con facilidad y viabilidad económica?				4	
8	¿ Según su criterio; el manual de patología es el adecuado para identificar fallas estructurales en las viviendas sociales ubicadas Lima Metropolitana?				4	
9	¿De acuerdo a lo descrito en la tabla A.6 del Manual, cree Ud. que promover la oferta de concreto premezclado "social"; brindaría un mejor desempeño en la calidad y durabilidad de los elementos estructurales en una vivienda social?					5
10	¿Cree Ud. que la aplicación del Manual previene desastres y brinda un mejor desempeño estructural en las viviendas sociales de Lima Metropolitana?					5
11	¿Cree Ud. que en el futuro el uso del manual promoverá comitivas inter barrio para la reparación de los elementos estructurales en dichas viviendas?					5
12	¿Cree Ud. que el manual es de fácil comprensión para un usuario inexperto?					5
13	¿Cree Ud que al haber incluido en el manual; los ensayos diamantinos en los elementos estructurales mejorará la detección temprana de patologías?					5
14	¿ Cree Ud. que la distribución y enseñanza del manual ayudará a disminuir el riesgo actual de las viviendas sociales en Lima Metropolitana?					5
15	¿Considera Ud. que haber incluido el uso de la Guía de Inspección Visual ACI 201. 1R 08, ensayos de diamante como el levantamiento estructural respalda al Manual en estudio?					5

Figure 17 Likert scale score 1.

		Muy en desacuerdo	En desacuerdo	Indeciso	De acuerdo	Muy de acuerdo
1	¿Considera Ud. que el formato presentado para el desarrollo de las tablas del manual es el adecuado?				4	
2	¿De acuerdo a su inspección; la visualización de las patologías mediante dibujos didácticos mostrados en el manual; es comprensible?				4	
3	¿Cree Ud. Que las características patológicas (Item 1.) ubicadas en el manual, se detallan correctamente?					5
4	¿Bajo su inspección ; podría con facilidad identificar en la realidad; las patologías mostradas en el manual?				4	
5	¿Cree Ud. que la explicación de las causas patológicas (Item2.) ubicadas en el manual; son las adecuadas?				4	
6	¿De acuerdo a la inspección del manual, considera Ud. que los materiales descritos para la reparación en el Item 3 (soluciones); cumplen con el objetivo de corregir el elemento estructural?				4	
7	¿ Cree Ud., según lo indicado en el Manual; el usuario podrá reparar sus elementos estructurales con facilidad y viabilidad económica?				4	
8	¿ Según su criterio; el manual de patología es el adecuado para identificar fallas estructurales en las viviendas sociales ubicadas Lima Metropolitana?					5
9	¿De acuerdo a lo descrito en la tabla N.6 del Manual, cree Ud. que promover la oferta de concreto premezclado "social"; brindaría un mejor desempeño en la calidad y durabilidad de los elementos estructurales en una vivienda social?				4	
10	¿Cree Ud. que la aplicación del Manual previene desastres y brinda un mejor desempeño estructural en las viviendas sociales de Lima Metropolitana?				4	
11	¿Cree Ud. que en el futuro el uso del manual promoverá comitivas inter barrio para la reparación de los elementos estructurales en dichas viviendas?					5
12	¿Cree Ud. que el manual es de fácil comprensión para un usuario inexperto?					5
13	¿Cree Ud que al haber incluido en el manual; los ensayos diamantinos en los elementos estructurales mejorará la detección temprana de patologías?					5
14	¿ Cree Ud. que la distribución y enseñanza del manual ayudará a disminuir el riesgo actual de las viviendas sociales en Lima Metropolitana?				4	
15	¿Considera Ud. que haber incluido el uso de la Guía de Inspección Visual ACI 201. 1R 08, ensayos de diamante como el levantamiento estructural respalda al Manual en estudio?					5

Figure 18 Likert scale score 2.

		Muy en desacuerdo	En desacuerdo	Indeciso	De acuerdo	Muy de acuerdo
1	¿Considera Ud. que el formato presentado para el desarrollo de las tablas del manual es el adecuado?					5
2	¿De acuerdo a su inspección; la visualización de las patologías mediante dibujos didácticos mostrados en el manual; es comprensible?					5
3	¿Cree Ud. Que las características patológicas (Item 1.) ubicadas en el manual, se detallan correctamente?					5
4	¿Bajo su inspección ; podría con facilidad identificar en la realidad; las patologías mostradas en el manual?					5
5	¿Cree Ud. que la explicación de las causas patológicas (Item2.) ubicadas en el manual; son las adecuadas?					5
6	¿De acuerdo a la inspección del manual, considera Ud. que los materiales descritos para la reparación en el Item 3 (soluciones); cumplen con el objetivo de corregir el elemento estructural?					5
7	¿ Cree Ud., según lo indicado en el Manual; el usuario podrá reparar sus elementos estructurales con facilidad y viabilidad económica?				4	
8	¿ Según su criterio; el manual de patología es el adecuado para identificar fallas estructurales en las viviendas sociales ubicadas Lima Metropolitana?				4	
9	¿De acuerdo a lo descrito en la tabla N.6 del Manual, cree Ud. que promover la oferta de concreto premezclado "social"; brindaría un mejor desempeño en la calidad y durabilidad de los elementos estructurales en una vivienda social?				4	
10	¿Cree Ud. que la aplicación del Manual previene desastres y brinda un mejor desempeño estructural en las viviendas sociales de Lima Metropolitana?					5
11	¿Cree Ud. que en el futuro el uso del manual promoverá comitivas inter barrio para la reparación de los elementos estructurales en dichas viviendas?					5
12	¿Cree Ud. que el manual es de fácil comprensión para un usuario inexperto?					5
13	¿Cree Ud que al haber incluido en el manual; los ensayos diamantinos en los elementos estructurales mejorará la detección temprana de patologías?					5
14	¿ Cree Ud. que la distribución y enseñanza del manual ayudará a disminuir el riesgo actual de las viviendas sociales en Lima Metropolitana?					5
15	¿Considera Ud. que haber incluido el uso de la Guía de Inspección Visual ACI 201. 1R 08, ensayos de diamante como el levantamiento estructural respalda al Manual en estudio?					5

Figure 19 Likert scale score 3.

Results:

With 225 points equivalent to 100% valid and reliable, it was obtained: 225 points giving as a result that the Structural Pathology Identification Manual evaluated reaches 94% of validity and reliability.

2.5. Ethical aspects:

This research was developed ethically under international and national regulations to provide more accurate data and solutions adjusted to reality, respecting the restrictions at the time of field development in 2020.

CHAPTER III. RESULTS

3.1. Indicator 1 for the description of the structure and materials used.

	Familias	MATERIALES USADOS
1	Valdez Quispe	**Ladrillo, Concreto y acero**
2	Nuñez	**Ladrillo, Concreto y acero**
3	Menacho	**Ladrillo, Concreto y acero**
4	Valdivia	**Ladrillo, Concreto y acero**
5	Mandujano	**Ladrillo, Concreto y acero**
6	Quispe Blaz	**Ladrillo, Concreto y acero**

Figure 20 Description of the materials used in the design of each house taken for the analysis.

		1. A DESCRIPCIÓN DE LA ESTRUCTURA	1. B MATERIALES USADOS (si se conocen)		Resultados
	Familias	Elmento	Resistencia f´c especificada (kg/cm2)	Resistencia f´c ensayada (kg/cm2)	Porcentaje alcanzado del ensayo con respecto a lo especificado
1	Valdez Quispe	**Columna 1**	280.00	97.28	35%
		Columna 2	280.00	161.48	58%
		Viga 1	280.00	110.69	40%
		Viga 2	280.00	90.01	32%
		Columna 3	280.00	97.28	35%
				PROM	**40%**

Figure 18 Results of elements tested and the average was 40% with how the concrete elements were constructed.

		1. A DESCRIPCIÓN DE LA ESTRUCTURA	1. B MATERIALES USADOS (si se conocen)		Resultados
	Familias	Elmento	Resistencia f´c especificada (kg/cm2)	Resistencia f´c ensayada (kg/cm2)	Porcentaje alcanzado del ensayo con respecto a lo especificado
2	Nuñez	**Columna 1**	210.00	98.99	47%
		Columna 2	210.00	59.95	29%
		Columna 3	210.00	84.88	40%
		Viga 1	209.00	92.02	44%
		Viga 2	210.00	165.21	79%
		Viga	210.00	93.07	44%
				PROM	**47%**

Figure 21 Results of elements tested and the average was 47% in relation to how the concrete elements were constructed.

		1. A DESCRIPCIÓN DE LA ESTRUCTURA	1. B MATERIALES USADOS (si se conocen)		Resultados
	Familias	Elmento	Resistencia f´c especificada (kg/cm2)	Resistencia f´c ensayada (kg/cm2)	Porcentaje alcanzado del ensayo con respecto a lo especificado
3	Menacho	**Columna 1**	210.00	175.07	83%
		Columna 2	210.00	159.03	76%
		PLACA	210.00	124.45	59%
				PROM	**73%**

Figure 22: Results of elements tested and the average was 73 % in relation to how the concrete elements were constructed.

			1. B MATERIALES USADOS (si se conocen)		Resultados
	Familias	Elmento	Resistencia f´c especificada (kg/cm2)	Resistencia f´c ensayada (kg/cm2)	Porcentaje alcanzado del ensayo con respecto a lo especificado
4	Valdivia	**Columna 1**	210.00	42.32	20%
		Columna 2	210.00	68.41	33%
		Columna 3	210.00	69.71	33%
		Viga 1	210.00	40.03	19%
				PROM	**26%**

Figure 23: Results of elements tested and the average was 26 % in relation to how the concrete elements were constructed.

		1. A DESCRIPCIÓN DE LA ESTRUCTURA	1. B MATERIALES USADOS (si se conocen)		Resultados
	Familias	Elmento	Resistencia f´c especificada (kg/cm2)	Resistencia f´c ensayada (kg/cm2)	Porcentaje alcanzado del ensayo con respecto a lo especificado
5	Mandujano	Columna 1	210.00	125.32	60%
		Columna 2	210.00	114.73	55%
		Columna 3	210.00	98.7	47%
				PROM	**54%**

Figure 24: Results of elements tested and the average was 54 % in relation to how the concrete elements were constructed.

			1. B MATERIALES USADOS (si se conocen)		Resultados
	Familias	Elmento	Resistencia f´c especificada (kg/cm2)	Resistencia f´c ensayada (kg/cm2)	Porcentaje alcanzado del ensayo con respecto a lo especificado
6	Quispe Blaz	**Viga 1**	210.00	78.03	37%
		Columna 1	210.00	42.32	20%
		Columna 2	210.00	68.41	33%
				PROM	**30%**

Figure 25: Results of elements tested and the average was 24% in relation to how the concrete elements were constructed.

According to Figures 17 to 23, it can be observed that the six single-family houses qualify as confined masonry according to Peruvian standard E.070 and as indicated in the delimitation of the present investigation. In addition, the resistance specified by the master builder and the laboratory test results (ASTM C42/C42M-20) is described.

3.2. Indicator 2: Nature of the environmental conditions

		1. A DESCRIPCIÓN DE LA ESTRUCTURA	2. NATURALEZA DE LAS CONDICIONES AMBIENTALES Y DE LAS CARGAS			3. INDICADORES DE PELIGRO
	Familias	Elmento	Exposicion	Condiciones de Carga Viva (kg)	Condiciones de Carga Muerta (kg)	
1	Valdez Quispe	**Columna 1**	Medio Ambiente Arido/ temperatura media	2440	5972	Ninguno
		Columna 2	Medio Ambiente Arido/ temperatura media	2440	5972	Ninguno
		Viga 1	Medio Ambiente Arido/ temperatura media	4024	9584	Ninguno
		Viga 2	Medio Ambiente Arido/ temperatura media	4024	9584	Ninguno
		Columna 3	Medio Ambiente Arido/ temperatura media	2440	5972	Ninguno

Figure 26: Description of the Environment and conditions of Live, Dead load as indicators of danger.

		1. A DESCRIPCIÓN DE LA ESTRUCTURA	2. NATURALEZA DE LAS CONDICIONES AMBIENTALES Y DE LAS CARGAS			3. INDICADORES DE PELIGRO
	Familias	Elmento	Exposicion	Condiciones de Carga Viva (kg)	Condiciones de Carga Muerta (kg)	
2	Nuñez	**Columna 1**	Medio Ambiente Arido/ temperatura media	8430	18030	Ninguno
		Columna 2	Medio Ambiente Arido/ temperatura media/ abrasion minima	8430	18030	Ninguno
		Columna 3	Medio Ambiente Arido/ temperatura media/ abrasion minima	8430	18030	Ninguno
		Viga 1	Medio Ambiente Arido/ temperatura media/ abrasion minima	3660	8680.8	Ninguno

Figure 27: Description of the Environment and conditions of Live, Dead load as indicators of danger.

		1. A DESCRIPCIÓN DE LA ESTRUCTURA	2. NATURALEZA DE LAS CONDICIONES AMBIENTALES Y DE LAS CARGAS			3. INDICADORES DE PELIGRO
	Familias	Elmento	Exposicion	Condiciones de Carga Viva (kg)	Condiciones de Carga Muerta (kg)	
3	Menacho	**Columna 1**	Medio Ambiente Arido/ temperatura media	5064	12000	Ninguno
		Columna 2	Medio Ambiente Arido/ temperatura	1764	4698	Ninguno
		PLACA	Medio Ambiente Arido/ temperatura	5064	12000	Ninguno

Figure 28: Description of the Environment and conditions of Live, Dead load as indicators of danger.

		1. A DESCRIPCIÓN DE LA ESTRUCTURA	2. NATURALEZA DE LAS CONDICIONES AMBIENTALES Y DE LAS CARGAS			3. INDICADORES DE PELIGRO
	Familias	Elmento	Exposicion	Condiciones de Carga Viva (kg)	Condiciones de Carga Muerta (kg)	
4	Valdivia	**Columna 1**	Medio Ambiente Arido/ temperatura media	516	1422	Esta vivienda presenta asentamiento minimo en la fachada
		Columna 2	Medio Ambiente Arido/ temperatura media/ abrasion minima	806	2002	
		Columna 3	Medio Ambiente Arido/ temperatura media	516	1422	
		Viga 1	Medio Ambiente Arido/ temperatura media/ abrasion minima	1662	3630	

Figure 29: Description of the Environment and conditions of Live, Dead load as indicators of danger.

		1. A DESCRIPCIÓN DE LA ESTRUCTURA	2. NATURALEZA DE LAS CONDICIONES AMBIENTALES Y DE LAS CARGAS			3. INDICADORES DE PELIGRO
	Familias	Elmento	Exposicion	Condiciones de Carga Viva (kg)	Condiciones de Carga Muerta (kg)	
5	Mandujano	**Columna 1**	Medio Ambiente Arido/ temperatura media	5644	12068	--
		Columna 2	Medio Ambiente Arido/ temperatura media	5644	12068	--
		Columna 3	Medio Ambiente Arido/ temperatura media	5644	12068	--

Figure 30: Description of the Environment and conditions of Live, Dead load as indicators of danger.

		1. A DESCRIPCIÓN DE LA ESTRUCTURA	2. NATURALEZA DE LAS CONDICIONES AMBIENTALES Y DE LAS CARGAS			3. INDICADORES DE PELIGRO
	Familias	Elmento	Exposicion	Condiciones de Carga Viva (kg)	Condiciones de Carga Muerta (kg)	
6	Quispe Blaz	**Viga 1**	Medio Ambiente Arido/ temperatura media	2084	4890.4	
		Columna 1	Medio Ambiente Arido/ temperatura media	3250	7280	
		Columna 2	Medio Ambiente Arido/ temperatura media	3250	7280	

Figure 31: Description of the Environment and conditions of Live, Dead load as indicators of danger.

According to Figures 22 to 27 and the information mentioned in Annex 2, the environmental conditions are described with the following results: The houses present mild aggressive environmental exposures that lead to types of pathologies in their structural elements. It is observed that the environment is arid or dry; characteristic of the district of Ate Vitarte, finding minimal abrasion in some elements.

Of the total number of homes, 33% are affected by the environmental conditions in this district located in Lima; this type of finding invites us to evaluate the conditions where the homes analyzed are located for the development of the Manual.

3.3. Indicator 3: Hazard indicators

According to Figures 22 to 26 and Annex 2, most houses do not currently present danger indicators, only the Valdivia family; there is a minimal differential settlement on the façade. In addition, the houses are suitable for repair and improvement of the concrete as a preventive measure so that they do not have danger indicators.

Of the total number of homes analyzed, 33% contain danger indicators; these are not high-risk, but a solution should be proposed, and repairs should be made.

3.4. Indicator 4: Current status of the structure.

			4. ESTADO ACTUAL DE LA SUPEERFICIE DEL CONCRETO					
	Familias	Elmento	Cond.	Superficies y acabados	Agrietamiento	Descascaramiento	Erosion	Revestimientos de superficie
1	Valdez Quispe	**Columna 1**	Regular	Lisa	Fisuracion superficial	--	--	Casco
		Columna 2	Buena	Lisa	Fisuracion superficial	--	--	Casco
		Viga 1	Buena	Lisa	--	--	--	Casco
		Viga 2	Buena	Lisa	Zona Superior/ fisuras por contracción plástica	Superficial		Casco
		Columna 3	Buena	Lisa	--	--	--	Casco

Figure 32: Current state of the concrete surface Fam. Valdez

			4. ESTADO ACTUAL DE LA SUPEERFICIE DEL CONCRETO					
	Familias	Elmento	Cond.	Superficies y acabados	Agrietamiento	Descascaramiento	Erosion	Revestimientos de superficie
2	Nuñez	Columna 1	Buena	Lisa	--	--	--	Tarrajeo
		Columna 2	Buena	Lisa	--	--	--	Tarrajeo
		Columna 3	Buena	Lisa	--	--	--	Tarrajeo / exceso de tarrajeo 6- 7 cm
		Viga 1	Buena	Lisa	--	--	--	Tarrajeo
		Viga 2	Buena	Lisa	--	--	Si, elemento antiguo <50años	Tarrajeo
		Viga	Buena	Lisa		Superficial	Si, elemento antiguo <50años	Casco

Figure 33: Current state of the concrete surface Fam. Nuñez

			4. ESTADO ACTUAL DE LA SUPEERFICIE DEL CONCRETO					
	Familias	Elmento	Cond.	Superficies y acabados	Agrietamiento	Descascaramiento	Erosion	Revestimientos de superficie
3	Mencacho	Columna 1	Buena	Lisa	--	--	--	Casco
		Columna 2	Buena	Lisa	--	--	--	Casco
		PLACA	Buena	Lisa	--	--	--	Casco

Figure *34*: Current condition of the concrete surface Fam. Mencaho

			4. ESTADO ACTUAL DE LA SUPEERFICIE DEL CONCRETO					
	Familias	Elmento	Cond.	Superficies y acabados	Agrietamiento	Descascaramiento	Erosion	Revestimientos de superficie
4	Valdivia	Columna 1	Regular	Oquedad / cangrejeras	--	Si, superficial	--	Casco
		Columna 2	Buena	Porosa/ cangrejeras	--	Si, 3 cm prof.	--	Casco
		Columna 3	Buena	Porosa	--	Si, superficial		Casco
		Viga 1	Regular	Poroso	--	Si, 3 cm prof.	--	Casco

Figure 35: Current state of the concrete surface Fam. Valdivia

			4. ESTADO ACTUAL DE LA SUPEERFICIE DEL CONCRETO					
	Familias	Elmento	Cond.	Superficies y acabados	Agrietamiento	Descascaramiento	Erosion	Revestimientos de superficie
5	Mandujano	Columna 1	Buena	Lisa	--	--	--	Casco
		Columna 2	Buena	Lisa	--	--	--	Casco
		Columna 3	Buena	Lisa	--	--	--	Casco

Figure 36: Current state of the concrete surface Fam. Mandujano

			4. ESTADO ACTUAL DE LA SUPEERFICIE DEL CONCRETO					
	Familias	Elmento	Cond.	Superficies y acabados	Agrietamiento	Descascaramiento	Erosion	Revestimientos de superficie
6	Quispe Blaz	Viga 1	Buena	Lisa	--	--	--	Tarrajeo
		Columna 1	Buena	Lisa	--	--	--	Tarrajeo
		Columna 2	Buena	Lisa	--	--	--	Tarrajeo

Figure 37: Current condition of the concrete surface Fam. Quispe Blaz

According to Figuress 27 to 33 and Annex 2, the houses present cracks due to plastic shrinkage, superficial cracking, crabbing, superficial peeling of up to 3 cm, porosity and excess tarring. Obtaining that 50% of the total of the analyzed houses present some deficiency in the state of their structural elements. The great amount of incidence that represents the state of the houses demonstrates the correct representation of the findings.

3.5. Indicator 5: On Beams

According to figures 18 to 23 and Annex 2, it can be observed that the lowest resistance presented was 40 kg/cm2, and the best performance was 165 kg/cm2.

These results provide a solution for reinforcing or improving these elements for the continuation of more floors.

And in general, 100% of the houses present deficiencies in the compressive strength of the concrete designed and used.

3.6. Indicator 6: In columns

According to Figure 18 to 23 and Annex 2, it is observed that the lowest resistance presented was 42 kg/cm2 and the best performance; was 175 kg/cm2, this type of result provides precision in the elements to consider their durability and quality; revealing pathologies in the future that visibly is not currently shown of each Dwelling.

These results provide a solution for reinforcing or improving these elements for the continuation of more floors.

Moreover, in general, 100% of the houses present deficiencies in the compressive strength of the concrete designed and used.

After the evaluation of the visual inspection of the concrete in the housing - ACI 201.1R-08 and the diamond tests, the hypothesis is accepted; since the Manual of repair of structural elements for social housing applies to the types of housing in the delimitation of the present project and the pathologies (according to the findings of the indicators). Likewise, the tests provided in accuracy the quality of the concrete made in Insitu. Therefore, the repair solutions are more accurate and reliable for the current social housing problems.

CHAPTER IV. DISCUSSION AND CONCLUSIONS

4.1. Discussion

- According to the results obtained in the description of the structure and materials used, it was found in our study the six houses are single-family and confined masonry; the results obtained by Cortes & Perilla (2017) indicate that description of the structure and materials used coincide with the research.

- According to the results obtained like the environmental conditions, it was found in our study that the dwellings do not present strong, aggressive exposures due to the environmental conditions in the study area (arid or dry). According to the results obtained in Cortes & Perilla (2017), they indicate that if it presents aggressive exposures of corrosion and machas by humidity, these results are different because in the reference study, it has other environmental conditions.

- According to the results obtained in the hazard indicators, it was found in our study that this represents 20% of the total. Cortes & Perilla (2017) indicate that between 60%-80% of the total, these results are different because the reference found settlements and damage in their structures and in the study, a slight settlement is presented.

- According to the results obtained in the current state of the structure, it was found in our study that 50% of the total analyzed houses present deficiency in the state of their structural elements, according to the results obtained in Cortes & Perilla (2017) indicates that 100% of analyzed educational entities present deficiency in their state, these results are different by the use of the building and by the time of useful life of the concrete remaining to each building.

4.2. Conclusions

- From the results obtained, it is established that visual inspection of the concrete in the house - ACI 201.1R-08 as; the description of the structure and materials used are six confined masonry houses, according to Figures 22 to 27, the nature of the environmental conditions presents the environmental exposures of the area, according to figures 17 to 23, the hazard indicators in our study presented 20% of the total. Figures 22 to 26 present the current state of the structure, finding that 50% of the total analyzed houses present deficiency in the state of their structural elements. Figures 27 to 33 allow for determining the Identification of structural pathologies for the repair of masonry social housing by means of an identification manual.
- From the results obtained, it was established that the Diamantina tests on beams and columns showed that 100% of the houses had deficiencies in the compressive strength of the concrete designed and used in these elements, which allows establishing a precise repair by means of a structural pathology identification manual.

From the results obtained for the development of a manual for the Identification of structural pathologies, the description of the structure and materials used for single-family houses of confined masonry, the nature of the environmental conditions if it presents the types of exposures, the danger indicators represent 20% of the total, of the current state of the structures 50% of the total analyzed houses present deficiency in the state of their structural elements. Furthermore, the diamond tests on beams and columns showed that 100% of the houses present deficiency in resistance to concrete compression. Therefore, developing a manual will allow the Identification and repair of masonry social housing in structural elements.

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